

Latka

# Biological Assessment

## Missouri National Recreational River

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U.S. National Park Service, Midwest Region  
and  
U.S. Army Corps of Engineers, Omaha District

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## 1.0 INTRODUCTION

### 1.1 Designation of River

A 59 mile stretch of the Missouri River between Gavins Point Dam and Ponca State Park was added to the National Wild and Scenic Rivers System by a 1978 amendment (Section 707 of the National Parks and Recreation Act) to the Wild and Scenic Rivers Act of 1968. Components of the National Wild and Scenic Rivers System are classified as wild, scenic, or recreational, based upon the amount of development existing in the river corridor at the time of designation. The 59 mile reach of the Missouri River from Gavins Point Dam to Ponca State Park was classified as recreational and is known as the Missouri National Recreational River (MNRR). Primary responsibility for implementing the project was assigned to the Secretary of the Interior, while secondary responsibility was given to the Secretary of the Army acting through the Chief of Engineers. In 1980 the Secretary of the Interior and the Chief of Engineers signed a Cooperative Agreement which gave overall administrative authority to the Department of the Interior, while day-to-day management of the river was assigned to the Corps of Engineers.

### 1.2 Purpose of Assessment

The interior least tern population of the species, *Sterna antillarum athalassos*, was designated as endangered on May 28, 1985, while the northern great plains population of the piping plover, *Charadrius melodus circumcinctus*, was designated as threatened in January, 1986. Under Section 7 requirements outlined in the Endangered Species Act and subsequent amendments, federal agencies are required to determine the effects of their actions on any species which are listed or proposed for listing. The assessment will not cover two other federally listed species, the bald eagle listed in 1978, and the peregrine falcon, listed in 1973. A biological assessment completed in 1985 by the Omaha District concluded that the MNRR would not likely affect these species. The U.S. Fish and Wildlife Service, acting as an administrator of the Endangered Species Act, concurred in this determination.

The Missouri River Division, Corps of Engineers, has been preparing information related to potential effects of the entire Missouri River mainstem operations on federally listed species since 1986. This information has since been made available to the U.S. Fish and Wildlife Service, who have issued a draft biological opinion on mainstem hydrologic and related effects on bald eagles, least terns, and piping plovers. The purpose of this assessment is to determine the effects of recreation, bank stabilization and other activities on least terns and piping plovers along the MNRR. Effects of construction and operation of the mainstem system on the MNRR are also evaluated, since this was a preceding federal action. Also, the flow release pattern from Gavins Point reservoir essentially controls the river ecosystem within the MNRR. Cumulative effects, or possible future state and local actions, are also considered.

The pallid sturgeon (*Scaphirhynchus albus*) is also discussed in the assessment, because it has been proposed for listing in late summer of 1990 (USFWS, 1990a). However, the assessment for the pallid sturgeon should be considered as only preliminary, since the Missouri River Division will be "conferencing" with the U.S. Fish and Wildlife Service on the effects of mainstem operations on the these rare fish. These conferences will likely include studies which will provide a better knowledge of the life history requirements of the pallid, and determine if recovery is possible and feasible. The USFWS informally requested an evaluation on the paddlefish (*Polyodon spathula*) since they have been petitioned to review its status. However, this species is now considered as a Category 3C species, and doubt exists that it will ever be listed because of: (1) its local abundance along the Missouri River, (2) its ease of propagation, and (3) intent of states to manage them as sport fish. The American burying beetle (*Nicrophorus americanus*) and western prairie fringed orchid (*Platanthera praeclara*) were listed in 1989. However, since there have been no recorded incidences of these species in the study reach, and the probability of occurrence appears low, no assessment work will be attempted at this time. Should subsequent field surveys indicate otherwise, an additional biological assessment will be prepared.

## 2.0 STUDY AREA CHARACTERISTICS

### 2.1 General

The Missouri River at this location is in the middle portion of the 2,300 mile long Missouri River, and flows through the upper dissected till plains of the Central Lowland Province. Original vegetation was of the tall grass prairie type, with ribbons of the eastern deciduous forest extending into the till plains along the major river valleys.

### 2.2 Location

The upstream end of the project is at Gavins Point Dam, River Mile (RM) 809.9, while the downstream end is just below Ponca State Park, RM 751.9. The river channel forms the approximate boundary between the states of Nebraska and South Dakota. The corridor of the river segment includes the river channel, selected slopes visible from the river, and lands above the river bank required to preserve the river characteristics. An early river management plan (USACE, 1980a) identified the corridor as containing about 19,600 acres. With the exception of lands under the mean high water mark of the river, most of the corridor is in private ownership (Figure 1).

### 2.3 Climate

A moist, subhumid climate prevails in the study reach. It experiences temperatures noted for wide fluctuations and extremes. Skies are usually sunny. Summers tend to be hot and humid while winters are cold and dry. Mean July temperature is 76°F, while that in January is 20°F. Growing season length is slightly more than 150 days, while average annual precipitation is 23.5 inches at Yankton, near the upstream end. The amount of ice in the river during the winter varies, depending upon flow releases from the dam and the length of time that arctic air masses stagnate over the area. The river immediately below the Gavins Point Dam is usually open, while downstream reaches may become partly or entire frozen over between December and March. During mild winters the river does not completely freeze over.

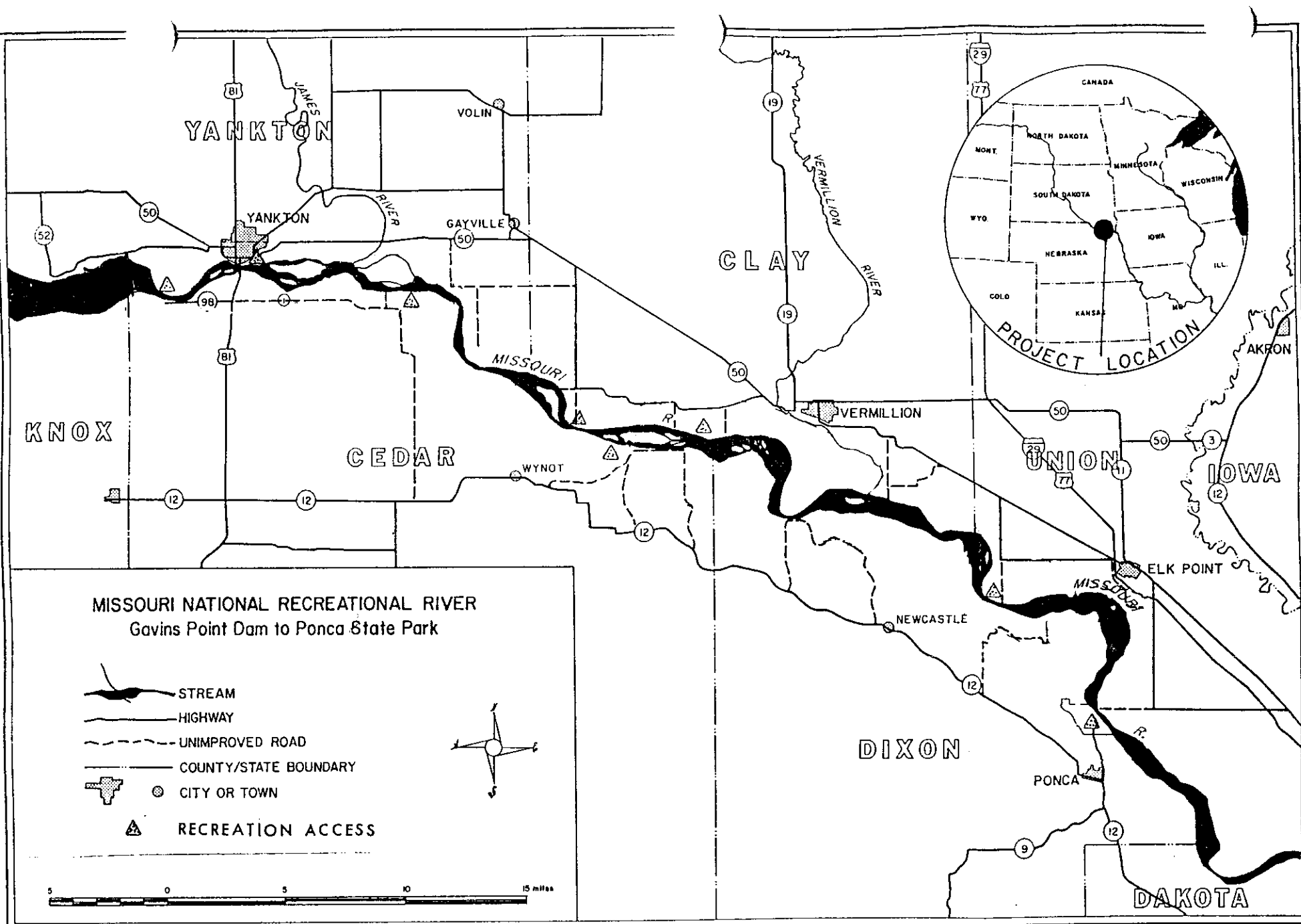


Figure 1

On the Nebraska side, the river meanders frequently against heavily wooded bluffs, while in South Dakota a broad, nearly flat flood plain stretches north for many miles. During past floods, the channel frequently shifted its course, creating new channels, isolating old channels, and destroying and building islands. Present flood plain relief and surface features, especially numerous meander scars and a few oxbows, largely reflect these alluvial events. At some sandy overbank depositions, subsequent wind action has created sand dunes.

The present flood plain surface was last reshaped by the large and widespread flood of 1952. Since river regulation, flows have been confined within the channel, and changes largely reflect low flow bank and island erosion. Because of extensive bed degradation during the past 25 years, the channel has been lowered several feet so that in many reaches it is now entrenched 10-15 feet below the adjacent flood plain. The channel has also widened in many areas due to lateral bank erosion in geologically "soft" deposits, and in places is now over one mile wide. There are several reaches, however, where considerable natural control exists due to resistant clay or cobble deposits, and the channel cross section has been relatively stable. Based on erosion rates computed under pre-MNRR project conditions (1964-1977) and post-project conditions 1978-1985), the amount of new channel area is estimated to be between 3,000 to 4,000 acres. Channel slope averages about 1 foot per mile, but varies from reach to reach. In some reaches, it has decreased slightly in slope since the closure of Gavins Point Dam, while in other reaches it has increased slightly. Channel bottom deposits are typically sand, but some reaches are partly armored with gravel or cobble, and within some natural control areas such as at sharp bends, a solid clay bottom may exist. There are several long, fairly straight or moderately sinuous reaches where bed conditions are in a state of flux in response to seasonal changes in flows. Constantly changing dunes and troughs are typical bed forms in these reaches. These features develop and move downstream during the summer high flow period, but during low discharge periods in winter, are believed to be more stable. While little dune movement may occur, the tops of the dunes do become truncated, and these dunal areas become a sediment supply source for downstream areas. In sharp bendway areas, as next to a bluff, the channel may be very deep and quite narrow.



The channel is still in its natural partly meandered and braided form, and no avulsions have occurred. Under these conditions, a wide range of flow velocities occur (near zero to 8 feet per second). Due to flow regulation, however, the character of stream erosion and deposition is different in that high islands and overbank deposits are no longer forming (USACE, 1980a).

The river islands vary in size, elevation, sediment composition, age and nature of vegetation. They can be broadly grouped as: (1) old islands, formed before river regulation; or (2) new islands, formed after regulation. The former were built by large floods, are mantled with coarser sediments, are covered with early to mid successional woody vegetation and are no longer subject to flooding and sediment deposition. The latter have existed for less than 40 years, were built by regulated flows, are lower in elevation, are composed of fine sands and silts, are susceptible to flooding and waterlogging, and are either largely barren or covered by early seral stages of woody, herbaceous, or wetland vegetation.

## 2.5 Hydrology

The flow characteristics of this river segment have changed drastically since development of the mainstem for flood control, navigation, and hydropower in the 1950's through early 1960's (Figure 2). The naturally occurring high flood flows no longer exist. These were generally coincident with the spring snowmelt period from the plains, or the early summer storms on the plains combined with melting of snow pack in the mountains. Not infrequently, there were two flood peaks each year. Based on flow models of regulated and unregulated stream conditions during a 33 year period between 1957-1989, high flows would have exceeded 60,000 c.f.s. in 24 years and 10 times would have exceeded 100,000 c.f.s. The mean annual high flows under unregulated conditions exceeded 86,000 c.f.s. Since 1957, peak flows exceeding 60,000 c.f.s. occurred only three times--1972, 1975, and 1976. Flows exceeding 40,000 c.f.s. have been more frequent, but have not been sustained enough or timed to provide scouring of the higher sandbar islands. The mean annual high flow now slightly exceeds 36,000 c.f.s. Low flows are also very different. Under nonregulated conditions, flows frequently fell below 10,000 c.f.s. and sometimes dropped below 5,000 c.f.s. Under regulation, flows typically do not drop below 10,000 c.f.s., even in winter or in drought periods

# GAVINS POINT RELEASES

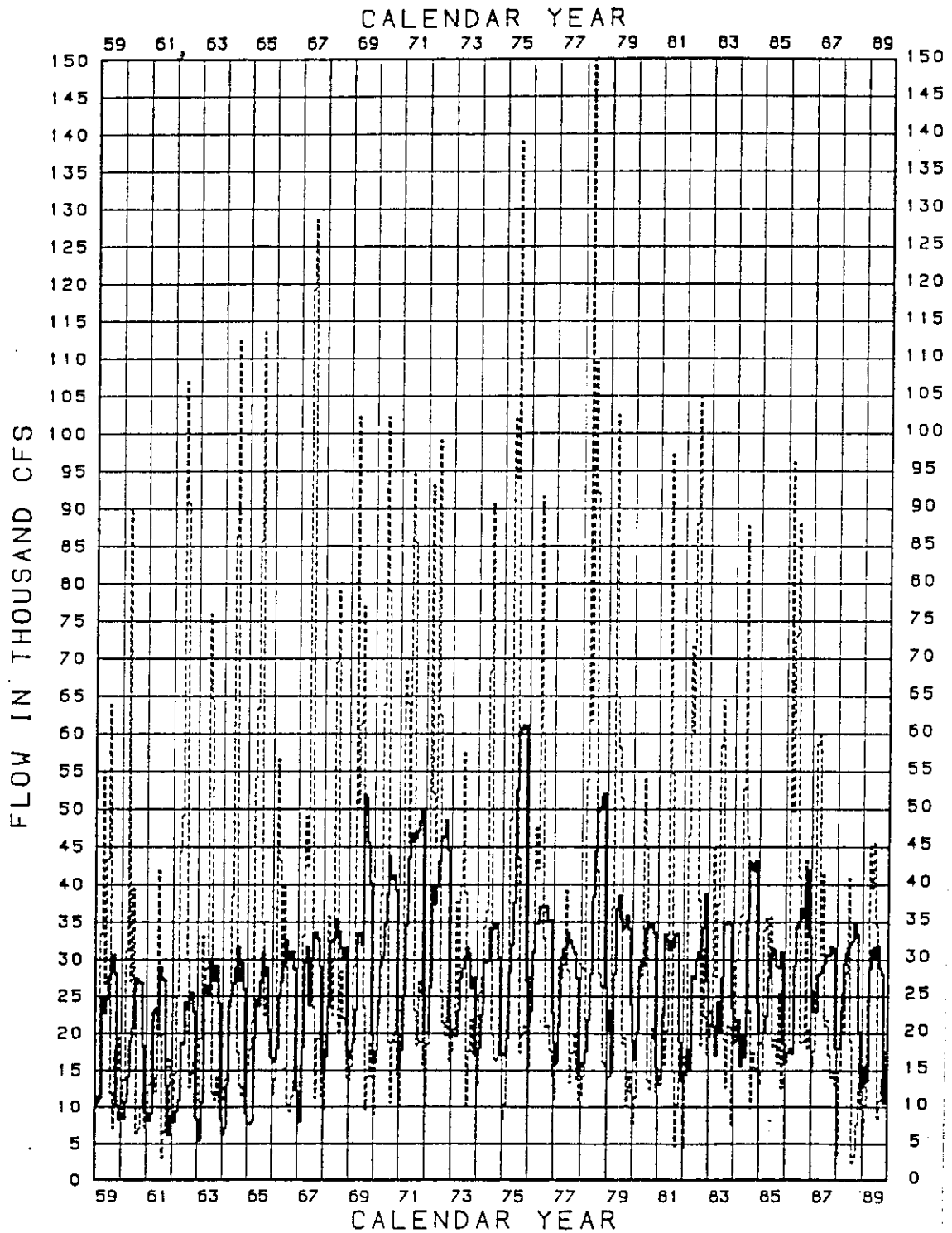


Figure 2

(USACE, 1988a). Figure 2 graphically shows the changes in flow regime during the 1955-1985 period.

The changes in flow rates during the pre-regulation period led to wide fluctuations in river stages. The higher unregulated stages flooded and scoured the islands and overbank areas; receding and low stages exposed areas along the banks and side or mid-channel sandbars. If it is assumed that a 10,000 c.f.s. change in discharge affects the river stage by 1-1.5 feet, the typical high river flow now is about 5-7.5 feet lower than under unregulated conditions (86,000 c.f.s.-36,000 c.f.s.  $\times$  1-1.5 ft/10,000 c.f.s.= 5-7.5 feet). Actual difference in water surface elevations between unregulated and regulated conditions are likely greater than this due to the increase in channel capacity effect. The overall effect of these influences has been a dramatic reduction in channel bed scour on higher channel areas.

Under regulated conditions discharge rate transitions from summer to winter and winter to summer flows usually occur in late November, and March or April.

Near record drought conditions prevailed over the upper Missouri Basin during 1987-90, and a sizeable portion of storage in upstream reservoirs was used. As a result, maximum annual flow releases during this period from Gavins Point Dam were all less than 35,000 c.f.s., and reached a low maximum flow of 31,500 c.f.s. during 1989 (USACE, 1988; USACE, 1990a). In 1990, flow releases during much of the summer were 25,000 to 27,000 c.f.s.

## 2.6 Land Use

Land uses in the river corridor include agricultural, seasonal and permanent residences, commercial, transportation, recreational, and fish and wildlife habitat (USACE, 1980a; USACE, 1985).

Agricultural uses of the corridor dominate. Past erosional losses of cultivated high bank land have been minor and these losses have been replaced by additional clearing of high bank woodlands or reclamation of lower bank accretion lands. Both irrigated and non-irrigated crops of corn or soybeans are grown. A few hay production and grazing lands also exist along the river, especially in wet

areas or in bottomland woodlands. Most of the residential and commercial development is concentrated from the Yankton area upstream to Gavins Point Dam. Downstream of Yankton, scattered residences and clusters of residences are found along county roads which provide access to the river. Developed areas are found at the Vermillion boat club area, the two Cedar County Park areas, and the Ponderosa area near the mouth of the Vermillion River.

Public parks and river access areas are found on the Nebraska side at Gavins Point Dam (RM 811), two locations in Cedar County (RM 799 and 785), and at Ponca State Park (RM 754) at the extreme downstream end. Areas in South Dakota include Riverside Park at Yankton (RM 805-806), the Myron Grove (RM 787), and the Clay County Park (RM 780.5). Existing recreation for the area at the time of designation was 950,000 recreation days (USACE, 1980a). Major activities are fishing, swimming, boating, camping, picnicking, and hunting. This use was projected to increase by 750,000 days by 1990 (USACE, 1978).

Wildlife management areas are all located in bottomland areas in South Dakota. These include the Warren, Clay County, Bolton, Frost and Myron Grove state game management areas. These areas are managed primarily for whitetail deer. Other lands provide wildlife habitat, but are not designated for that purpose. An unknown amount of these lands adjacent to the river have been lost to erosion. The river banks along these areas are currently unprotected.

## 2.7 Fish and Wildlife Habitat

Most of the terrestrial habitat areas are found along the steep bluff and drainages entering the river on the Nebraska side, or adjacent to the channel. Principal habitats include sandbar, sand dune, cottonwood-willow, cottonwood-dogwood, elm-oak, and agricultural lands (Clapp, 1977).

The elm-oak community is a community of the higher bluffs, while the others are found in the bottomlands. The sandbar, sand dune and cottonwood-willow are all early to mid seral types, with the cottonwood-dogwood community representing a later seral stage.

Extensive losses of bottomland woodlands due to conversion to agricultural purposes was noted between 1956-1975 in a land use and habitat study (Siouxland Interstate Metropolitan Planning Council (SIMPKO, 1978). Since then, however, rate of loss has declined and losses during the past 10 -12 years are estimated to be between 5-10 percent. In some high bank areas deterioration of bottomland stands due to mortality of cottonwoods has been noted. However, due to the widening and degradation of the river and lower river stages, new cottonwood stands appear to be regenerating at rates exceeding mortality. These new stands are on most of the larger islands and within accretion areas found along the river bends.

The sand dune areas, relics of the 1952 and earlier floods (Clapp, 1977) are best observed along the South Dakota side, especially near the Warren area near Elk Point. Comparisons of existing with older photographs indicate they are becoming invaded with woody vegetation, and assuming the characteristics of a woodland savanna.

Vegetated islands, with a variety of seral stages representing both upland and wetland communities, provide the most habitat diversity in the corridor. They are the least disturbed, and have the most habitat value for terrestrial and semi-aquatic wildlife.

Open sandbar habitat was identified as important habitat for shorebirds and as loafing area for wintering waterfowl (Clapp 1977). The amount of this habitat type in the river channel has greatly declined since operation of the mainstem system. The SIMPKO study cited losses of over 4,000 acres between 1956 and 1975. Schmulbach et al., 1981, reported only 2,200 acres of sandbar habitat remaining as of 1977. By 1985 sandbar acreage had further shrunk to 1,500 acres (USACE, 1989), and in 1990 observations indicated that this habitat type had deteriorated further.

Aquatic habitats along the MNRR were described by Kallemeyn and Novotny (1977). These included: main channel, main channel border, chutes (side channels), pools, confluences of tributary streams, submerged sandbars, and backwater/marsh. The reader is referred to this technical document for habitat and fish community descriptions. The backwater/marsh was singled out as very important as about

50 percent of the fish depended upon this habitat at some stage in their life history.

Volesky (1969) described the cattail marshes as being abundant along the river, comprising about 5 percent of the channel area. The marshes were typically found in backwater areas and often contained admixtures of young willows and cottonwoods. No significant areas of aquatic bed wetlands were apparently associated with these marshes/backwaters (Volesky, 1969; Nord, 1971). Loss of marshes, together with chute habitat, has been identified as an area of concern. Processes involved include siltation (Clapp, 1977) and bed degradation (Kallemeyn and Novotny, 1977). Siltation fills up the marshes, changing them to mesic environments, while bed degradation reduces the frequency of flooding and reduces ground water levels. While there have been reports of additional and continuing losses of these habitats in the 1980's (Schmulbach, 1990), a net loss cannot be confirmed or quantified as yet because some additional chutes and backwaters have been created in the river during the same time period.

## 2.8 Fish and Wildlife

The types of wildlife found in this area have been described generally by Clapp (1977) and the U.S. Department of the Interior (1979). The wildlife resource is very valuable as it provides much opportunity for hunting and nature observation. Mammals found in various terrestrial habitats along the river include 48 species. Only one species of big game (whitetail deer) occurs but many furbearers are found, including beaver, muskrat, mink, red fox, coyote, badger, raccoon, and weasel. Smaller mammals include mice, voles, moles, ground squirrels, and cottontails. Birds living in the area year-round include 25 species, while another 58 species commonly nest there. Fifteen species are winter residents. Over 100 species are transients, or utilize the area during, spring or fall migration. Several species of waterfowl are an important component of the avian fauna.

With the exception of tern and plover studies, bald eagle surveys, waterfowl surveys, and beaver studies, few scientific details on wildlife populations and their habitat use are known.

Federally listed wildlife which utilize the study area during the year include the bald eagle, interior least tern, and the piping plover. The river reach is considered to provide essential habitat for the least tern (USFWS, 1990b). The American peregrine falcon is a rare migratory transient. State of Nebraska or South Dakota listed species which could occur in the area on a temporary or permanent basis include the osprey, false map turtle, the western spiny softshell turtle, the eastern hog nose snake, northern water snake, and the river otter.

Although the pattern of flow and sediment loading have been drastically altered by mainstem operations, most of the native fish species are still present (Schmulbach, et al., 1975; Kallemeyn and Novotny, 1977). The changed conditions, however, have reduced the dominance of fish species typical of large, turbid rivers, especially populations of paddlefish, river carpsuckers, buffalo fishes, and some native minnows, shiners, and chubs. Fishes found in various levels of abundance in the MNRR include shovelnose sturgeon, carp, channel catfish, sauger, walleye, white bass, goldeye, freshwater drum, river carpsucker, paddlefish, shortnose gar, smallmouth buffalo, largemouth buffalo, shorthead redhorse, blue sucker, gizzard shad, and several species of shiners and minnows. (Schmulbach, et al., 1975). Lack of spawning habitat and excessive fishing pressure is typically cited as the reason for decline of paddlefish and several other river fishes (Hesse and Mestl, 1990). The reach, however, affords a good sport fishery, with most angling concentrated in the reach between Yankton and Gavins Point Dam. Species important to least terns, e.g. shiners and minnows, are also abundant. A grass carp, an exotic, was caught in the river by Schuckman (1982), and in 1988-89 both bighead and grass carp were caught (Hesse, 1989). It is uncertain if grass carp numbers, given existing mortality factors, will be able to grow to sufficient numbers to threaten aquatic vegetation or other fish along the river.

Shallow marsh, backwater and chute habitats are utilized by macroinvertebrates, amphibians, aquatic birds and fish. About one-half of the river fish species utilize them for spawning and nursery areas (Kallemeyn and Novotny, 1977). The presence of snags in the main channel, abundant at some locations, provides considerable habitat structure for main channel-dwelling fish and also allows the growth of periphyton. Deep pool habitat also occurs in the main channel, along with numerous riffle areas. The presence of a stabilized bank in protected

reaches, also improves the habitat structure and food production for channel margin areas. There is some concern that the depth of pools behind islands has decreased in the past decade, possibly in association with island erosion and degradation (Schmulbach, 1990). These change seasonally and from year-to-year in response to flow conditions, however, so a conclusion cannot be made at this time.

Large populations of waterfowl winter in the reach when open water areas are present. Common species include the mallard and blue-winged teal. The most common wading bird along the river is the great blue heron, which was noted in large numbers in the summer of 1990.

The pallid sturgeon has recently been listed as a federally endangered species, while the sturgeon chub and sicklefin chub, now Category 2 species, could be listed in the future. The paddlefish and blue sucker are also under federal review but are both locally common in the Missouri River (Harberg, 1990). Of the above fishes, only the chubs and the pallid sturgeon are on the state endangered species lists.

### 3.0 CORRIDOR MANAGEMENT

Since designation of the river, implementation of scenic and fish and wildlife project components has been hampered by lack of a master plan and funding. In addition to bank stabilization, the plan originally envisioned detailed fish and wildlife habitat studies, cultural studies, and acquisition of scenic and other land rights to protect the corridor from piecemeal or fragmented development.

#### 3.1 River Access/Park Development

Since 1979, improvements to public access areas have been limited to the Yankton area, and a state of South Dakota boat ramp in the Myron Grove area. Significant improvements are being made at Riverside Park at Yankton, and include a new boat ramp with increased capacity. It is estimated this will double annual visitation rates in the Yankton part of the river in the near term (USACE, 1988b). Dixon County in Nebraska is also interested in developing a small river access area. There are also several private boat ramps along the river at rural residences.



### 3.2 Bank Stabilization

Construction of several, extensive streambank protection projects were authorized and completed under Section 32 of the Water Resources Development Act of 1974, and Section 161 of the Water Resources Development Act of 1976. Construction work was concentrated at several locations where bank loss was taking place at a rate of several acres annually. This work was intended to protect about 25 miles of bank length, or 21 percent of the total bank length within the MNRR. The work was also constructed to avoid impacts to chutes, backwaters, and other important aquatic habitats. Locations are shown in Table 1.

Table 1  
Section 32 Bank Stabilization Projects

<u>Project/General Location</u>	<u>Bank</u>	<u>River Mile</u>
Cedar Co. Park	Right	798-800
Goat Island	Left	795-798
Vermillion Boat Club	Left	782-787
Brooky Bottom Road	Right	783-787
Mulberry Bend	Right	775-776
Vermillion River Chute	Left	769-772
Ryan Bend	Right	767-769
Ionia Bend	Right	759-763
Elk Point I & II	Left	753-757

Since completed, these structures have required occasional rehabilitation and reinforcement to maintain the original project purpose. Several tiebacks or extensions have been required to prevent flanking or excessive scalping. Other work conducted by federal and local interests has been concentrated between Yankton and Gavins Point Dam. This has provided protection of the U.S. highway 81 bridge, the Yankton water plant, Sacred Heart hospital, and Riverside Park. Bank protection of some scattered rural developments has also been accomplished by local interests. In aggregate, these smaller projects have resulted in an additional 7 miles of bank stabilization, bringing the cumulative total to about 32 miles or nearly 27 per cent of the total bank mileage.

The Section 32 demonstration program, utilizing a variety of bank armoring and flow deflection devices (mostly revetments and short, spur dikes), has been very effective in controlling erosion at the designated sites. Structures were placed where they would not block or deflect flows from river chutes. In addition, at several locations, mature trees, shrubs, and grasses have become established over the riprap, restoring somewhat of a natural appearance to the banks. Remaining erosion problem areas on the left bank (South Dakota) include a site just upstream of the James River, an upstream reach of the St. Helena bendway, a reach upstream of the Myron Grove area, the Mulberry Point bendway, the Vermillion chute area, and the Bolton bendway. Along the right bank, problems exist downstream of Brooky Bottom, upstream of Alabama point, and at the Elk Point bendway upstream of Ponca State Park. Past Omaha District studies along the Platte River in regard to hydraulic effects of various structures have indicated that revetments and short spur dikes have only a minor hydraulic effect. While there is localized toe scour along the bank, they do not contribute to island degradation in the channel (USACE, 1990b).

Overall, the streambank erosion rate has been reduced from about 3.5 acres/river mile/year (USACE, 1978) to about 1.0 acre/river mile/year or a reduction of about 70 per cent (River Pro's, 1986). The existing annual average loss rate in terms of total acres is about 41 for the left bank and about 73 for the right bank. Erosion losses on the older James River and Goat islands have been high since closure of the dam. For the 1978-1985 period alone, total losses on these islands have been 24.3 and 51.1 acres, respectively. Specific hydraulic/geological parameters relating to these losses have not been evaluated.

From 1979-1985, sandbar island erosion of 273 acres was noted in the MNRR reach. Although this was partly balanced by formation of lower, new bars, a 16 percent net loss of surface areas was reported (USACE, 1989).

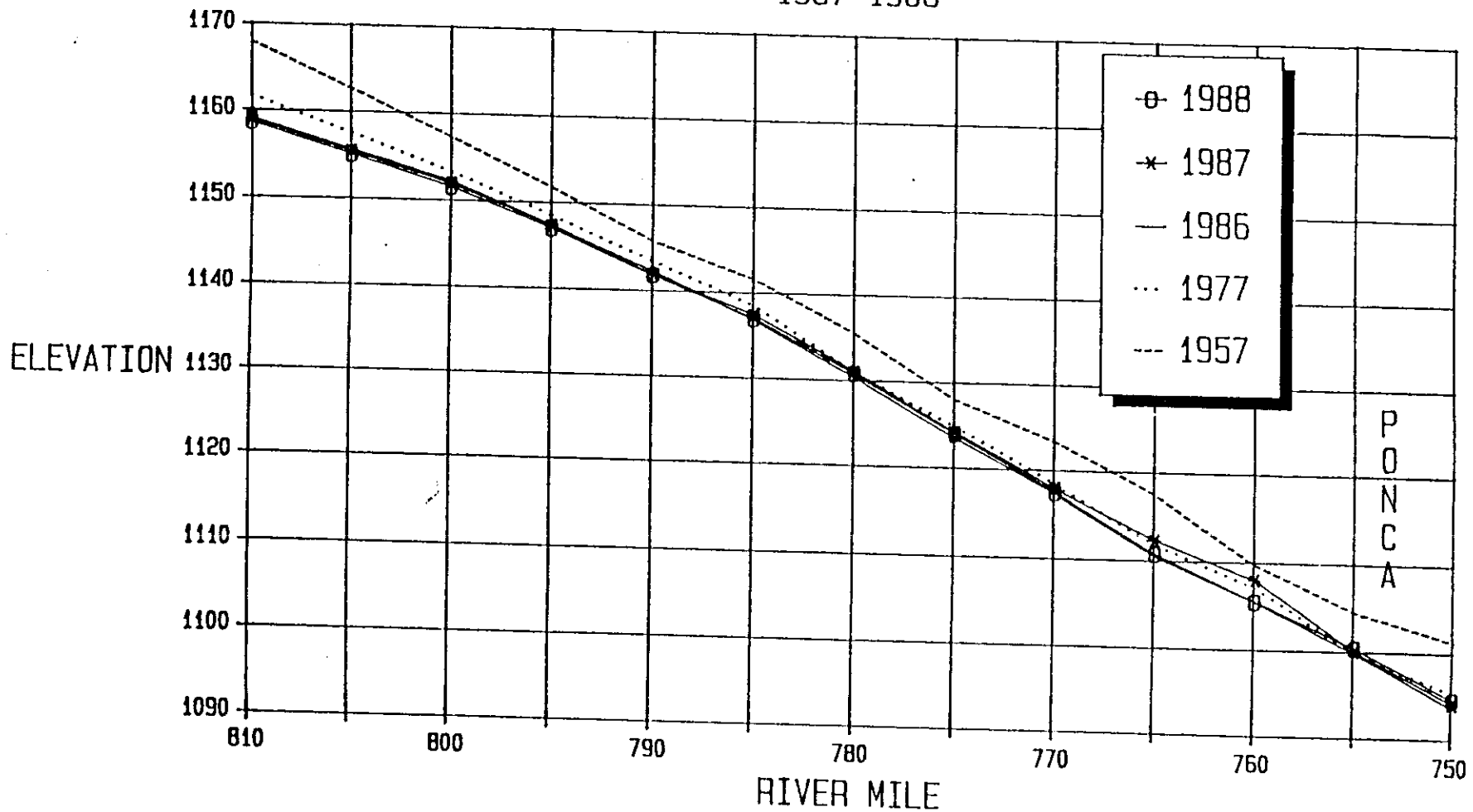
Section 33 of the Water Resources Development Act of 1988 directed the Secretary of Army to construct and maintain bank erosion projects on the Missouri River, including the MNRR. This provides a new source of funding for MNRR bank stabilization, but does not address the problem of resource loss in the shoreline corridor area.

### 3.3 Channel Changes

While the major channel alignment has not changed since construction of Gavins Point Dam, the channel has undergone change and continues to change. River bed degradation; e.g., loss of sediment from the bed of the stream to the point of bed lowering, has been a problem not only in the MNRR, but also downstream far below Sioux City, Iowa. It has resulted in adverse impacts to urban and rural infrastructure, induced erosion and resulted in loss of fish and wildlife habitat. Channel widening results from lateral migration of the thalweg over time, which is controlled by channel slope, bedload, and resisting forces of the bed and bank. In the MNRR, both bed degradation and lateral degradative processes have resulted in significant lowering of the water surface profile over time. While major channel avulsions have not occurred, an occasional new chute has been observed. The Omaha District has closely monitored the change in water surface profiles and channel morphology in the MNRR and downstream reaches, but definitive analyses of channel controlling factors have not been conducted.

As reflected by measurement of water surface profiles, channel change rates during the period 1957 to 1977 in the MNRR were relatively rapid. Since 1977, rates have significantly decreased, and some reaches have become more stable. Overall, the water surface profile decline has been greatest from Gavins Point Dam to Yankton (8-9 feet), with 5-6 feet declines at most other locations (Figure 3). Since 1977, decline near the James River island has been less than 1.5 feet, while there has been a slight increase just upstream of Mulberry Bend. Despite considerable armoring of the bed in the Yankton reach, continuing channel degradative influences are expected to cause additional water surface declines at rates of 0.1-0.2 feet per year. Similarly, declines would also be likely in the reach between Yankton and Ponca State Park. The apparent stability of water surface profiles in the Mulberry Bend and other bendway areas (note especially the reach from RM 770 to 780), is likely due to natural geologic controls such as hard clay or gravel deposits which resist erosion, and local hydraulic conditions. The continuing function of these controls over time is unknown. Thus, while past trends suggest that the period of rapid downward shifts in the water surface elevations has ceased, a slow rate of downward shift is expected in the future.

# ADJUSTED WATER SURFACE PROFILE 1957-1988



Prepared By brg  
Reviewed By gsc

MISSOURI RIVER  
GAVINS POINT DAM TO PLATTSMOUTH, NE  
DEGRADATION STUDY  
ADJUSTED WATER SURFACE PROFILE, 30000 CFS AT  
SIOUX CITY, IA, RIVER MILE 810 TO 760

Figure 3

### 3.4 Flow Regulation

Since the least tern and piping plover were listed in 1985, conflicts between river flow releases and nesting birds have surfaced. Nesting habitat areas were flooded, with resultant loss of reproduction. In 1985, the Nebraska Game and Parks Commission recommended flow measures to reduce flooding of nesting habitat. In response, the USACE (1989d) modified releases during the 1986-89 period in an attempt to accommodate nesting requirements. This was not successful in 1986 due to high system flows. Beginning in 1988, slightly higher flows were released during early May prior to nest initiation. The intent was to force the birds to nest on higher sandbar areas so that later releases made for navigation purposes would not flood the nests. These measures were helpful as mortality related to flooding of nests were reduced. During the 87-89 period, bird numbers reached the highest levels since surveys started in 1978.

The Nebraska Game and Parks Commission (1985) recommended higher flow releases during the non-nesting season in order to reduce vegetation encroachment on sandbars. No attempt has been made to examine the potential of this measure due to flooding and erosion concerns downstream.

### 3.5 Fish and Wildlife Habitat

There is no general fish and wildlife habitat plan for the reach; little if any fish and wildlife habitat has been preserved by acquisition of land rights. As expected, less than 5% losses of bottomland forest has occurred along the flood plain and the islands due to high bank erosion. Slightly higher losses, estimated at 5-10%, has occurred as a result of conversion of high bank woodland to cropland. A minor amount of low, accretion land has also been converted to cropland, which if undisturbed, would now be early successional woodland. Woody vegetation succession has also taken place on the older, higher islands, as well as on low-lying sandbars and marshes along the channel. While no studies have been conducted to assess aquatic life responses to the flow regime, an instream flow incremental methodology (IFIM) study has been initiated in the reach (Harberg, 1990). It is generally believed that flow levels could be improved to maintain wetlands and fishery conditions.

Experimental manipulation of vegetation to benefit sandbar habitat for least terns and piping plover was first initiated in late 1987 (USACE, 1989c). Methods used include tillage in 1987, followed by applications of herbicide in 1988-89. In 1988-89 limited mowing of vegetation was conducted. Aerial applications of Rodeo in 1988, followed by pre-emergent applications of Norsac 10g in spring of 1989, was effective in reducing vegetation growth on parts of two sandbar islands, totalling about 30 acres. In 1989 least terns attempted to nest on one of the islands, but nests were destroyed by predators. Piping plovers succeeded in fledging one bird. In 1990, the same sandbar areas were cleared which remained relatively bar the entire nesting season. Again, reproductive success was limited because of predation.

Despite the clearing attempts, overall sandbar habitat continued to deteriorate during the 1987-1990 period (Latka, 1990). Maximum daily outflow from Gavins Point during the growing season in both 1987 and 1989 ranged between 30,000 to 32,100 c.f.s., resulting in low stages and vegetation establishment into the scour zone (USACE, 1990). During the nesting season of 1990, flow levels were in the 25,000 to 27,000 c.f.s. discharge range, but again little nesting success was reported because of predation. By early September, a river survey indicated that additional vegetation encroachment had taken place on sandbars along the river, leaving suitable habitat only on the cleared islands on the upper river reach and on a few low sandbars downstream in the vicinity of the Vermillion River (Becker, 1990).

### 3.6 Recreation Management

Least tern and piping plover surveys over the years have identified significant adverse impacts on nesting birds, due to the large increase in river recreation in the past decade. Abandonment of colonies, loss of eggs, nests and fledglings have been reported (Ducey, 1981; Schwalbach et al., 1986; Schwalbach, 1988). Sandbars are attractive for such activities as hiking, camping, picnicking, sunbathing, swimming, volleyball, ATV,s and fireworks displays. In 1979, 12 of 13 sandbars containing tern colonies experienced heavy recreational disturbance. In 1987, twenty-six of 31 nesting sites (84 percent) in the study area received some disturbance.

As a result of these impacts, efforts to protect tern and plover nesting began in 1987. Informational signs describing the birds and their need for protection were designed by fish and wildlife officials and placed at the Bolten Area boat ramp, and 9 colony sites in the area. Despite the posting, six of the nine posted sites received some disturbance (Schwalbach, 1988). Posting and distribution of information on the birds continued at additional river access areas and islands during 1988-89. In 1989, bird losses due to human disturbance were nearly eliminated (Dirks and Higgins, 1989).

### 3.7 Regulatory Programs

Shoreline alteration activities along the MNRR are in part subject to Section 404 of the Clean Water Act, which regulates fill below the ordinary high water mark, and Section 10 of the River and Harbor Act of 1899, which regulates placement of refuse and obstructions in the river. Activities on the high banks are not subject to federal jurisdiction, but rather to any local land use ordinances as they exist in the respective jurisdictions. Water diversions or appropriations from the river for irrigation and other uses are subject to state law. Since passage of the recreational river designation, additional woodland and accretion land has been placed in cropland, some of which is under irrigation. Some of these lands are subject to periodic flooding, but do not necessarily come under Section 404 review unless they involve placement of fill in wetlands or channels.

In order to make the regulatory program more responsive to shoreline management objectives of the MNRR, a general permit was developed by the Omaha District for a five year period, 1982 to 1988, in order to target bank stabilization work proposed by individuals and local public entities. It did not directly apply to actions such as water intakes, pipelines, boat ramps, fences, marinas or actions landward from the high bank such as residential development or woodland clearing. This permit basically followed the model conditions and specifications developed for the Section 32 bank stabilization program, which provided for four alternative designs involving the use of graded rock riprap or bulkheads. An exception was that clean concrete was acceptable if it was graded and free of protruding steel or other materials. The permit, however, received limited use by the public due to technical, economic or other reasons, and regulation has

continued to follow the individual permit process. The latter has been rather cumbersome because the concerned federal agencies have different perceptions and goals on how the river should be administered (Hargrave, 1990).

Since the MNRR was designated in 1978, about 40 small projects have been authorized for local interests, providing for the stabilization of about 7 miles. At the present time about 6 permit actions are pending.

#### 4.0 STATUS AND NATURAL HISTORY ATTRIBUTES OF LISTED SPECIES

The purpose of this section is to highlight aspects of the natural history of listed species related to management of the MNRR.

##### 4.1 Least Terns and Piping Plovers

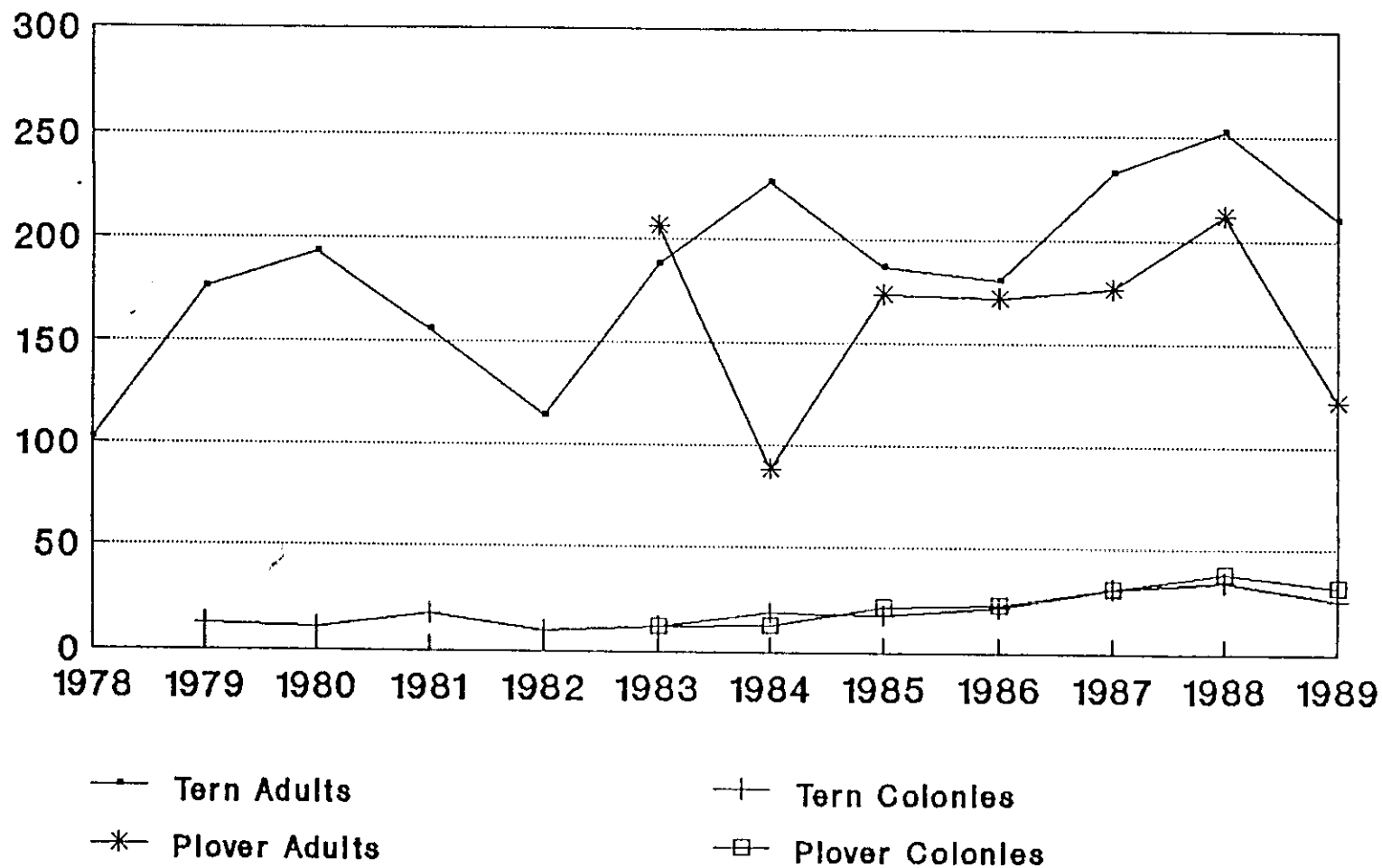
4.1.1. Population Levels--The entire lower and middle reaches of the Missouri River originally were inhabited by least terns and piping plovers. This pattern, however, changed as the river was developed. The influence of channelization on least terns in the Sioux City area was noted by Youngworth (1930), and the influence of recreation facilities development just downstream of Gavins Point Dam between 1959-1970 on displacement of a tern colony was observed by Hall (1975). Ducey (1985) suggested that the MNRR has been a refugia for terns.

Extensive surveys of interior least terns in 1986, 1987 and 1988 indicated the presence of 4,000, 4,800 and 3,959 individuals in the Missouri, Rio Grande, and Mississippi drainages. The Missouri River populations accounts for about 550 individuals or about 12 per cent of the total population (USFWS, 1990a). Surveys in the MNRR reach have been conducted by various concerned agencies since 1978 for least terns and since 1983 for piping plovers. The number of adults and colonies of both species has been fairly stable during this time (Figure 4). Least tern populations in the MNRR are the largest on the Missouri River, accounting for about 40 per cent. The number of piping plovers on the Northern Great Plains is estimated at 2,500. About 22 percent of the Northern Great Plains population is found along the Missouri River of which 34% is in the MNRR reach (USFWS, 1990a).



# LEAST TERN-PIPING PLOVER POPULATIONS

Missouri National Recreational River



Gavins Point Dam to Ponca, Ne

Figure 4

Reasons for the year-to-year fluctuations are not well understood. Habitat availability in other segments of the Missouri River, or in other Great Plains areas, river stage at time of nest initiation, and mortality incurred on the wintering grounds and during migration are also expected to affect the number of returning nesting birds. Recovery plans prepared for the least tern (USFWS, 1990b) and the piping plover (USFWS, 1988) have targeted desired population levels in the MNRR and the Fort Randall reach of the river. A level of 400 adults is desired for terns, and 500 adults for plovers.

4.1.2. Breeding Chronology--Least terns and piping plovers usually arrive at the MNRR from early to mid-May and begin nesting and incubation in late May and early June. Nesting chronology of the least tern is somewhat later than the piping plover. Due to high water conditions in some years, nesting may be delayed. This may have been the predominant nesting chronology pattern for the Missouri River system (Youngworth, 1930; Hardy, 1952), where nesting was not reported until June or July, after recession of the river from mountain snow melt or plains rainstorms. At the present time, if initial nests are destroyed, renesting efforts may continue throughout much of July (Dirks and Higgins, 1989). For least terns nesting usually takes place in June, lasting between 18-21 days. The fledgling phase typically occurs between late June and late July, lasting another 18-21 days. The post fledgling phase typically lasts 20 days, during the middle to late July and early August periods. In contrast, piping plovers have a 4-week incubation period, a five-week brooding period, and may nest a few days earlier than terns (Nebraska Game and Parks Commission, 1985). Terns and plovers generally leave the area in late August to early September.

4.1.3. Nesting Habitat Selection--Large rivers or lakes which have wide expanses of barren to sparsely vegetated sandbars and beaches, and wide buffers of open water, are preferred nesting habitat for interior least tern and piping plovers (Hardy, 1957, Ducey, 1981, Faanes, 1983; Nebraska Game and Parks Commission, 1985; Armbruster, 1986). Nesting parameters important to the birds, in addition to buffer distance from vegetation or the water line, include height of the sandbar or beach, percent vegetation cover, height of vegetation cover, substrate and availability of food. Previous nesting success is also likely important. Nest siting is generally timed to follow the recession of spring or early summer high flows or lake levels (Ganier, 1930; Stiles, 1939; Hardy, 1957; Schulenberg,

et al., 1980). Preferred nesting sites are relatively barren sandbars, with vegetative cover of less than 20 per cent, and vegetation heights generally less than 40 cm (Schwalbach, 1988). Selection for elevation above the river water level is also an important variable for nest siting. Before river regulation, birds on the Missouri River likely selected the higher sandbars far from the water's edge, but given the vegetation encroachment problem on the MNRR, birds are now forced to locate on the lower-elevation bars closer to the water. Plover and tern site selection studies in 1986-87 in the MNRR indicated little variation in both horizontal distance from heavy vegetation cover and vertical distance above the water surface (Schwalbach, 1988). In 1986, mean distance of least tern nests from vegetation was 65 feet, whereas nests were placed only 0.63 feet above the water surface elevation. In 1987, nests were separated by a mean space of 88 feet from vegetation and by a 1.5 foot water surface elevation buffer. These data contrast sharply with early studies of interior least tern nest siting on other large rivers (Ganier, 1930; Hardy, 1957), and coastal least terns (Thompson, 1982) where buffers from dense vegetation were 1-several thousands of feet, distances to water were in excess of 100 feet, and elevations were 5 feet or more higher than the existing water surface. It also contrasts with 1988 nesting site surveys for piping plovers along Fort Peck reservoir, where plover nests were initiated from 2.8-6.3 feet above the water level (USFWS, 1989).

Due to the sometimes transitory nature of nesting habitat, McNicholl (1975) described least terns as having weak site tenacity, but strong group adherence. However, least terns have also been noted to display high site fidelity by continuing to use an area year after year as long as the site remains suitable (Burger, 1984), including marginal sites where successful nesting has occurred (Massey and Atwood, 1979). Recent studies on the Platte River (Lingle, 1988), indicated that only 23 per cent of the terns, and only 40 per cent of the piping plovers, returned to their natal colony. Most, however, returned to the same general area of the river. Distances of marked birds from their banding origin along the Platte varied from 0 to 80.5 miles for terns and 0 to 86.5 miles for plovers.

In terms of substrate preference, dry conditions are more important for nesting than texture. While terns nest on the fine to coarse sand characteristic of MNRR sandbars, they also nest on gravels, on salt-encrusted mud flats (Grover, 1979;

Schulenberg, et al., 1980), and even on gravel-surfaced parking lots (Schwalbach et al., 1986). Along the Platte River, birds are using sand and gravel spoil areas more than the river sandbars (Dinan and Carlson, 1982; Dinan, 1983; Faanes, 1983; Lingle, 1988). The coastal race of the least tern has been reported nesting on gravel or shell-roof tops of public buildings (Fisk, 1978; Hays, 1980), and occurs more commonly on dredge disposal islands having a wide variety of substrates than on the sands of the natural barrier beaches (Thompson, 1982). Piping plovers are also not highly selective in terms of substrate. They nest on coarse gravels, fine sands or even on salt-encrusted mud flats (Dinan and Carlson, 1982; Dinan, 1983; Prindiville, 1986; Lingle, 1988).

Proximity of food to the nesting site is more important for least terns than plovers. Plovers not only feed on a wide variety of small, benthic invertebrates along the shoreline, but also on terrestrial insects such as grasshoppers and beetles (Prindiville, 1986; Lingle, 1988). Least terns, however, prefer fish, and probably are opportunistic in this regard, feeding in any body of water that supplies fish such as minnows, shiners, killifish and other small fish (Hardy, 1957; Schulenberg et al., 1980; Dinan, 1985). The fishing location is generally not over 1-2 miles (Youngworth, 1930; Schulenberg et al., 1980; Lingle, 1988) from the nesting colony, although preferred distance is likely considerably less (Faanes, 1983; Armbruster, 1986). Location of the feeding site may also be affected by turbidity. Near Sioux City, Stiles (1939) observed that the terns fed on oxbow lakes when the Missouri River was in high flow condition and turbid, and along the Mississippi River, Ganier (1930) observed much feeding in the quieter waters of oxbows and borrow pits behind levees. Along the Platte River, least terns also forage in sand pit lakes (Dinan and Carlson, 1982). Some foraging of terns on insects (Schulenberg et al., 1980) has been reported and for terns in marine locations, crustaceans, mollusks and annelids (Marples, 1934; Witherby et al., 1941).

4.1.4. Breeding and Rearing Success--Many factors can curtail the breeding success of both least terns and piping plovers. Part of this is due to their habit of nesting in exposed areas along water bodies, that are susceptible to flooding, erosion, temperature extremes, aerial and ground predators, trampling, hailstorms, windstorms, and other natural hazards (Ganier, 1930; Stiles, 1939; Tout, 1947; Hardy, 1952, Schulenberg, et al., 1980; Ducey, 1981; Dryer and Dryer,

1985). These factors may act singly or additively on breeding success. For example, Burger and Lesser (1979) found increased predation in common tern (*Sterna hirundo*) colonies that had been partially destroyed in flooding, and suggested that sufficient numbers of protective adults must be maintained for successful mobbing of predators. The few remaining terns in a partially destroyed colony did not attempt to chase Franklin's gulls that landed near nests, although they would have earlier.

Low breeding success in many shorebird species, especially a high loss rate of eggs and chicks, may be balanced or mitigated by the apparent longevity of the birds. Annual adult survivorship of 0.85 has been recognized for relatively long-lived gulls and terns (Ricklefs, 1973). Marples (1934) assumed that on an average least terns in England lived an average of 5 years. Banding and recovery records of least terns, as of 1980, showed that nearly 17% (13 of 78) of the recoveries exceeded 10 years and 6.4% exceeded 15 years. Two birds, banded as chicks, were found 21 years later (Thompson, 1982). Adult survivorship values of the interior least tern have not been developed, and the proportion of older, experienced individuals in the nesting population is not known. In banding studies on the Platte River, however, return rates of banded birds have been low, and older birds were few. Least terns had a return rate of 30 percent, while that for Piping plovers was only 16 per cent (Lingle; 1988).

Preliminary studies of birds fledged successfully per breeding pair have been conducted in conjunction with MNRR surveys (Schmulbach, 1988; Dirks and Higgins, 1989). These data are presented in Table 2.

Table 2  
Least tern and Piping Plover Populations and Nesting Success

Least Terns

<u>Year</u>	<u>Adults</u>	<u>Fledged</u>	<u>Fledged/Pair</u>
1986	181	14	0.16
1987	232	80	0.67
1988	252	62	0.49
1989	210	58	0.55

Table 2 (Cont'd)

## Least Tern and Piping Plover Populations and Nesting Success

Piping Plovers

<u>Year</u>	<u>Adults</u>	<u>Fledged</u>	<u>Fledged/Pair</u>
1986	172	4	0.05
1987	177	100	1.13
1988	212	66	0.62
1989	122	13	0.21

The fledging rates for terns are below those reported recently by Smith (1988) for least terns nesting on the Mississippi River (1.0), and by the USFWS (1990a) for the upper Missouri River between Fort Peck dam and Lake Sakakawea (1.64). They are slightly better than rates (0.33-0.46) determined for birds on the Platte River in 1988 (Lingle; 1988). They are also close to the weighted national average fledging ratio from 1980-1988 computed to be about 0.54 chicks/pair (USFWS, 1988b). Thompson (1982) estimated that ratios of 0.5 to 0.7 fledgings per pair are needed for maintenance of coastal least terns in Texas. Ratios greater than the weighted national average are evidently needed if the population is to recover significantly.

Fledging rates for piping plover in the MNRR are also considerably lower than those estimated as necessary to maintain the population. In North Dakota saline wetland flats, Prindiville Gaines and Ryan (1988) estimated an annual fledging rate between 1.2-1.4 chicks/pair were necessary. Fledging rates for piping plovers provided with nesting enclosures were reported to be high (2.3) on beaches of Lake of the Woods, Minnesota, (Allan, 1988), and to be 3.0 on Cape Cod beaches on the Atlantic coast (Rimmer, 1987). Rates without nesting protection were 1.1 on the northern Great Plains (Prindiville Gaines and Ryan, 1988), and only 0.24 along the Platte River (Lingle, 1988).

4.1.5 Mortality Factors--Factors significantly disrupting nesting or causing mortality in the MNRR reach include flooding, predators and human disturbance. These factors can also lead to social disintegration of ternaries. Flooding is a recurrent problem because suitable sandbars have little relief above the water surface. Rises in discharge, resulting from higher releases or tributary flood flows, flood nests and young birds, causing significant mortality. This has been

identified as a significant problem in most years (Ducey, 1981; Nebraska Game and Parks Commission, 1985; Schwalbach, 1988). Predation of not only nests but adult birds is a common problem for shorebirds, including terns and plovers. Surveys and studies in the Great Lakes, and Mississippi and Missouri River drainages have documented mortality occurrences from coyotes, barred owls, great horned owls, ring-billed gulls, and crows (Hardy, 1952; Schulenberg, *et al.*, 1980; Dryer and Dryer, 1985; Lingle, 1988; Smith, 1988). Many other predators have been observed near nesting terns and plovers and are suspect. Prior to 1987 predation on the MNRR was not reported as significant (Schwalbach, 1988). However, in 1988 and 1989 predation overshadowed other nest mortality factors.

Predators accounted for 28 and 61 per cent of all least tern nest losses in 1988 and 1989, respectively, while piping plover nest losses for the same years were 25 and 83 per cent (Dirks and Higgins, 1988 and 1989). Predators observed near colonies include mink, coyote, dog, raccoon, opossum, northern harrier, red-tailed hawk, crow, great blue heron, several snakes, and ring-billed gull. In 1989 direct predation from a dog, mink, and great horned owl was observed (Dirks and Higgins, 1989).

Incidents of predation on nesting terns and plovers tend to increase once vegetation cover and structure develops on a beach or sandbar (Soots and Parnell, 1975). Similarly, in the MNRR, increased predation would be expected due to greater probability of vegetated islands providing food and cover for predators. Flooding or other disruptions of colonies may also increase vulnerability to predation (Hardy, 1957; Schulenberg and Schulenberg, 1982). This causes nest and chick abandonment. In the case of terns, the birds which lose nests may move elsewhere or at least are not inclined to engage in "mob" behavior when potential predators encounter a nesting site.

Human recreational disturbance on sandbars has contributed to tern and plover losses in the area. Birds may be repeatedly driven away, nests crushed, or young birds trampled on or scattered. Ducey (1979) reported that 12 of 13 sandbars supporting colonies experienced recreational disturbance. This finding was substantiated since through additional observations (Nebraska Game and Parks Commission, 1981). In 1987, 26 of 31 (84 percent) of colonies were reported to be disturbed, and one colony was abandoned (Schwalbach, 1988). In the 1988-89

period, Dirks and Higgins (1988; 1989) indicated that about one-half of the nesting disturbances were low-impact and that extensive visitor education and control techniques significantly reduced losses. It is generally recognized that tern colonies are able to withstand considerable disturbance, unless the disturbance is direct or chronic. In a study of coastal terns in Texas, it was noted that direct human disturbance occurred at least weekly at 90 percent of the sites; 31 percent were visited by humans during 3 or more days during the week, and 13% were disturbed daily. Despite this fairly frequent incidence of intrusion, detrimental effects were only apparent at sites with vehicle access (Thompson, 1982). A colony site on a beach at Rockport, Texas, has been exposed to nearby heavy human use for several years (Thompson, 1990). Boat fishing does not likely disturb nesting colonies, but recreational boating, which creates waves and sandbar erosion, could create direct and indirect adverse effects. Human habitation is a growing land use along the MNNR shoreline. However, actual direct disturbance to tern and plover colonies has not been documented, since distance typically provides a buffer zone (Ducey, 1981). These birds are also quite tolerant of human presence as long as there is no overt vandalism (Thompson, 1982).

#### 4.2 Pallid Sturgeon

4.2.1. Taxonomy and Population Levels--Pallid sturgeon (*Scaphirhynchus albus*) and shovelnose sturgeon (*Scaphirhynchus platorynchus*) are very closely related fishes, as determined by electrophoretic and morphological studies. The pallid sturgeon is believed to have been an occasional resident along the middle and upper Missouri River, prior to impoundment of the river by dams. Over 500 sturgeon were captured by fisherman after being trapped in Lake Francis Case, Lake Sharpe, and Lake Oahe (Keenlyne, 1989).

Pallid sturgeon numbers dwindled because of construction of dams on the river. This likely affected reproduction and feeding and other activities (Keenlyne, 1989). Currently, pallid sturgeon are known or possibly exist in parts of the Missouri mainstem and near the confluences of major tributaries such as the Yellowstone, Platte, and Kansas Rivers. The shovelnose sturgeon, however, has been able to maintain numbers in the unchannelized and free-flowing parts of the



river (Schmulbach, et al., 1975; Kallemeyn and Novotny, 1977). Population estimates were as high as 3,000/km (Schuckman, 1982).

Small numbers of pallids have been recently documented in the river above Fort Peck Lake, Fort Peck Dam to Garrison Reservoir, in the headwaters of Lake Oahe, below Oahe Dam in the upper end of Lake Sharpe, and in the river below Gavins Point Dam to the mouth of the Kansas River. Only three pallids have been caught in the MNRR in the past 20 years (Gilbraith, et al., 1988), while only twelve fish have been captured within the entire Missouri River during the past 1-2 years.

4.2.2. Breeding Chronology--These conditions are poorly understood but are assumed to be similar to those of the shovelnose sturgeon, since natural hybridization occasionally occurs with the pallid (Carlson, et al., 1985). Pallid sturgeon are slow growing and mature at an unknown but probably advanced age. One specimen was aged at 27 years (June, 1981), and three others at 10, 37 and 41 years (Gideon, 1990). Males are known to spawn at 3-4 years, and females perhaps at 5-6 years. Frequency of spawning is low, once every 3-5 years. Spawning likely occurs from June 1 to August 1, but has not been well documented (Gilbraith et al., 1988). It may be triggered by day length, water temperature or flow rises. Spawning likely takes place over gravel or rock substrates in areas subjected to moderate water velocities. This may be at the mouths of tributaries or along or in the main river channel at temperatures from 67-70 F (Christensen, 1975). Eggs would be expected to take from 5-8 days to hatch, and would be subject to burial by moving bed loads and other problems at these times. Detailed larval search studies by Kallemeyn and Novotny (1977) and Hesse and Mestl (1988) between 1975 through 1987 did not reveal any proof of spawning in the MNRR, although it could occur over isolated areas of gravel and cobble in the river if thermal and other conditions were favorable. Despite numerous other surveys, occurrence of pallid spawning in the entire Missouri drainage system has not been confirmed.

4.2.3. Riverine Habitat--Shovelnose and pallid sturgeons prefer large, turbid river systems. Impoundment of these systems cause reductions in sturgeon. Along the Missouri mainstem reservoirs, North Central Reservoir Investigations (NCRI) documented that catches declined drastically each year after impoundment

(Shields, 1958; Sprague, 1959). These studies ceased in 1975 and now a data gap exists on pallid sturgeon life history. For this reason, information on shovelnose sturgeon is added in order to assemble a tentative habitat profile for pallids.

Studies have shown that shovelnose sturgeon are abundant in riverine pool areas behind sandbars in fall, winter and spring seasons, from 1.8 to 4.6 m deep and with slow currents (Schmulbach et al., 1975; Moos, 1978; Novotny and Kallemeyn, 1977). In summer, shovelnose sturgeon were quite evenly distributed among different riverine habitats, possibly related to availability of food, reproductive activities or cooler waters released in large quantities from Gavins Point Dam (Moos, 1978). In the Mississippi River, young shovelnose sturgeon were frequently collected near submerged rock wing dams (Helms, 1974). In general, habitats utilized by pallids appear to be similar to those of shovelnose (Kallemeyn and Novotny, 1977).

Pallid and shovelnose sturgeons are considered to be opportunistic feeders, consuming aquatic insects, crustaceans, mollusks and annelids. Trautman (1957) reported congregations of shovelnose sturgeons in river beds containing large quantities of small clams and snails. In some cases, fish and fish eggs have been found in the diet of pallid sturgeons including small forage fishes and sauger. The location of the mouth on the ventral surface, protrusile lips for sucking, presence of sensory barbels and small eyes, suggests primarily a feeding habit of raking the bottoms of turbid waters. When the barbels encounter a food item, the material is ingested along with any loose substrate. Food studies of the shovelnose in the Missouri River indicated a predominance of chironomids, mayfly larvae, and caddisfly larvae (Held, 1969; Modde, 1973; Garner and Steward, 1987). In the MNRR, the lower body condition of shovelnose may be related to inadequate food supply related to degraded habitat conditions (Modde, 1973; Whitely and Campbell, 1974; Hesse, 1987). It has been noted that pallid sturgeon are smaller in the lower river (Gavins Point Dam to the Kansas River) than those in the upper Missouri River (Garrison Dam to Fort Peck Dam), where more natural river habitat conditions are found (Harberg, 1990).

4.2.4. Mortality--These factors are poorly understood. Studies on shovelnose sturgeon in the MNRR have indicated that they are relatively parasite and disease

free (Keenlyne, 1989). The same would probably be true for pallids. Mature pallids are not known to be taken by any predator except man. The fate of young pallids, however, is not known. A general increase of piscivorous fishes has characterized the Missouri River and its impoundments in the past 30 years. Large predators include white bass, walleye, and various salmonids. White bass and skipjack herring, both of which occur in the MNRR, are sight feeders and were not reported in the Missouri River until recently (Funk and Robinson, 1974). Eggs of lake sturgeon are vulnerable to suckers, carp, catfish and even other sturgeon species (Becker, 1983), and it is very possible that the eggs of pallids are also consumed by other fish. In some aquatic systems, exotic predator fish have been known to decimate populations of native fishes utilizing smaller prey.

There may be inter-specific competition between pallid and shovelnose sturgeon, especially since the river habitat has been hybridized and simplified, reducing suitable habitats for spawning and feeding. Indeed, competition for spawning may be indicated by the occurrence of hybridization between the two species (Pflieger and Grace, 1986). Commercial fishing operations, which take a wide variety of river fish, could also result in loss of some pallid sturgeon if captured fish were mistaken for shovelnose and not released. Also, sturgeons are easily entangled in drift nets.

4.2.4. Management--All states along the Missouri River consider the pallid sturgeon as endangered or threatened, except the state of Montana, which identifies it as a species of concern. All of these states have a "must release regulation," except in Montana where pallids under 16 pounds can be taken legally. Recently, the state of North Dakota has prohibited the taking of all sturgeon, even the shovelnose, as this species is not easy to differentiate from young pallids (Harberg, 1990). Sturgeon culture is conducted at some Federal hatcheries in the United States. The U.S. Fish and Wildlife Service operates a federal hatchery at Gavins Point Dam and is conducting some limited studies on sturgeon propagation. It is generally agreed that artificial propagation of pallids is needed if there is any hope of conserving the pallid sturgeon.

## 5.0 PROJECT IMPACTS ON LISTED AND PROPOSED SPECIES

### 5.1 Related Actions--Mainstem Operations

Mainstem operations exert both direct and indirect effects on riverine biota. These effects are discussed below.

#### 5.1.1. Direct Effects

5.1.1.1. Terns and Plovers--Flow releases, causing flooding and accompanied by erosion of sandbars used by nesting terns and plovers, will continue to keep reproductive success in the MNRR at lower than desirable levels. Nesting success would be near zero during high flow years such as that which occurred in 1975 and 1979. Flooding of colonies or parts thereof is also socially disruptive. Chicks are abandoned, there is less defensive behavior from the parents, and greater predation losses would be expected. If flooding is recurrent or chronic on an annual basis, the population will be displaced to other locations where reproductive success will be temporarily better, but still unreliable on a long term basis. Even alternative locations such as sand pits, sand dunes, or wide lake beaches are very scarce along much of the Missouri River. Only during extended drought periods are wide, barren beaches exposed on the large upstream reservoirs, and during high inflow years, these habitats would not be available due to rising lake pool levels. In conclusion, continuing and recurrent losses of nesting birds are expected in the future along the MNRR because the available nesting habitat is very low. If Gavins Point Dam releases do not directly flood the nests and disrupt the colonies, flooding from adjacent tributaries, and sandbar erosion are other factors which can cause losses.

In addition to flow-related concerns, a chronic, long-term sandbar habitat exists. The large, channel-forming flows of the pre-dam era, which alternately scoured and built the islands and overbank areas, are now part of history. The effects of regulated flows are concentrated at the lower edge of the high river banks and along the edges of the open, sandbars. The stream can now only form low sandbars which are susceptible to flooding under flow levels needed for navigation releases. Currently, bank erosion on remaining habitat is a significant problem as cleared islands are also eroding. Net erosional losses

of sandbar islands of about 2 per cent per year were reported (USACE, 1989d), and are expected to continue.

5.1.1.2. Pallid Sturgeon--This fish apparently exists in very low numbers in the MNRR. While various circumstantial factors related to river operation, e.g., blockage of migration to suitable spawning habitat in the main channel or in tributaries, the river flow regime, and loss of rearing or feeding habitat are likely significant contributors to the population decline, other factors such as competition may also be involved. Future studies, conducted as part of the conferencing process with the U.S. Fish and Wildlife Service, may provide insight into the various physical and biological habitat factors which are limiting to this species.

#### 5.1.2. Indirect Effects

5.1.2.1. Vegetation Encroachment on Sandbars--The sandbars along the MNRR, due to the reduction of scouring, presence of suitable mineral texture and composition, water supply and favorable climatic conditions, are easily colonized by pioneer vegetation. Establishment of herbaceous and woody, perennial plants on sandbars occurs rapidly, resulting in descent of the vegetated zone into the river channel, with concomitant loss of the nesting area between the vegetation and the open water zone. Lack of high flows in subsequent years, coupled with degradation, then enables the process to be repeated at a slightly lower elevation, and plant cover developed during the previous year becomes more dense and tall, resulting in eventual sandbar stabilization. In early 1990, the vertical distance between the vegetation and the water line during February flow conditions (14,000 c.f.s.) in the reach was 1-2 feet. At flow releases of 31,000 c.f.s. in early September 1990, the water level was high enough to flood all of the sandbars with the exception of those which had been cleared. In some reaches, a small part of the vegetated zone was also inundated (Becker, 1990).

5.1.2.2. Encroachment and Predation Relationships--Development of plant cover and vegetation structure on the islands has potential to increase predatory loss on eggs, young and adult birds in two ways: (1) provide more habitat for a greater number and diversity of predators; and (2) increase the probability of

predation on the birds. In recent drought years, increase of predation may also be related to reduced prey availability along the river.

The change of sandbars to later seral stages involves the development of marshy areas, grassland areas, shrublands and woodlands. Habitats are created for numerous predators. Also, shorebirds lose distance and space as a buffer against predators. The net result of the encroachment is an increase in the numbers of potential predators in remaining sandbar areas, further reducing nesting success. As previously discussed, fledging success rates for both terns and plovers along the MNRR are already low.

5.1.2.3. Channel Degradation--During the 1960's and 1970's, bed degradation and channel widening led to lower water surfaces, resulting in bare sandbars for nesting at successively lower elevations. This process has maintained better sandbar habitat than in the Fort Randall reach, where less widening and degradation has occurred. However, in recent years in the MNRR, the vegetation encroachment rates have exceeded the rate of water surface decline. Only a renewed down-cutting of the stream or a period of scouring or at least sustained flooding of the vegetated islands would renew the habitat which has been lost during the past decade. As stated previously, water surface decline has lessened greatly during the past decade, and it is possible that less than 1 foot of additional decline will be experienced.

## 5.2 Recreation River Designation

### 5.2.1. Recreation Use Effects

Since river recreation is expected to nearly double under MNRR designation, competition for sandbars in the river with terns and plovers will continue to increase since the period of demand overlaps considerably. This competition is intensified by the declining amount of the resource. Least terns will lose out in this competition, as they have already in parts of the MNRR. The Missouri National Recreation River plan originally envisioned development at 13 sites along the MNRR below Yankton. To date, public facilities are provided at only four of these. While channel instability and other adverse hydraulic parameters have discouraged some public uses, overall recreational use has greatly increased

over the years. This is especially the case near Yankton, where public facilities have been overloaded during periods of peak use.

The most recent Nebraska State Comprehensive Outdoor Recreation Plan (SCORP), indicates there are shortages of river access areas and related facilities in the planning area served by the MNRR. A new boat access area in Dixon County is currently proposed to meet part of this demand. The latest South Dakota SCORP (1987) identifies a significant shortage of water-based facilities in the service area of the MNRR. While completion of the new facilities at Yankton's Riverside park will satisfy considerable demand in the upstream part, another community envisions a need for more development. The city of Vermillion is interesting in developing a park and river access area at Mulberry Point, about 30 miles downstream from Yankton. Additionally, private landowners along the river are expected to request river access areas. If permitted, this would increase visual impacts along the shoreline as well as add to existing river use.

In summary, recreational use will increase significantly in the near and mid term. Nesting terns and plovers will experience higher levels of disturbance. Since suitable alternative sites are not available, reproductive success will be further reduced during the nesting and brooding season.

#### 5.2.2. Bank Stabilization

Future federal projects similar to the Section 32 level of effort are not expected on the MNRR. Future work would likely be confined to maintenance of the existing system with minor extensions in adjacent problem areas. Section 404/10 permit requests for private bank stabilization are expected to continue as in the past. Short term construction work, e.g., reshaping the unstable banks of the river, followed by placement of stabilizing material on the banks, would not by itself directly affect the sandbar habitat of terns and plovers, or aquatic habitat of the pallid sturgeon. The hydrologic effect of this work is to arrest channel widening at the point of construction. While some local scour occurs near the protected bank, the effect does not extend into the sandbar and pool habitat of the main channel. Also, the work is normally accomplished when the birds are not on the river, and also at times and places where pallid sturgeon spawning, feeding, and resting activities would not be likely, as

important habitats for this fish are submerged gravels for spawning and deep river pools and quiet backwaters for other life stages. In essence, the river now provides only transient habitat for the pallid sturgeon, and the additional work will likely have little effect.

Long term small, but not measurable indirect effects on hydraulic properties and turbidity of the stream would be expected from continuing private bank protection and other bank alteration actions. Potential work could be conducted along about eight miles of stream where bank erosion is severe or critical. This work could induce some additional development of residential areas which could create additional competition between river users and shorebirds for limited sandbar space. The bank protection actions, however, would have an insignificant effect on the existing channel degradation trend and vegetation encroachment problems. Any deep pool, backwater habitat, or other aquatic habitat used by transient populations of pallid sturgeon would not be expected to be adversely affected since the work is to be accomplished on the bank, and no flow alteration would take place.

### 5.3 Cumulative Effects

Cumulative effects are those effects of future State or private actions, not involving a Federal action, that are reasonably certain to occur within the action area. These are added to the environmental baseline for an effects determination. Future and existing federal activities, including federally permitted actions (Section 404 and Section 10) are subject to Section 7 consultation under the Endangered Species Act requirements. These actions are generally not considered to be cumulative to the proposed action. The ongoing island clearing and visitor control activities are experimental and are not part of environmental baseline conditions. The future condition of the river channel is only in general terms considered to be part of the environmental baseline, e.g., it is known that some unspecified but generally small amount of further degradation will occur. Detailed channel stability studies in the MNRR have not been conducted.

Major future activities along or within the river corridor which are not subject to federal permits are those which do not affect wetlands or are above the mean



high water mark, or are authorities specifically left to local or state governments. These activities generally include jurisdiction on how flood plain lands are to be used; e.g., agricultural, residential, transportation and industrial uses. Also included is authority for water appropriation. More intensive agricultural use of the river corridor is expected in the future. This will include limited additional clearing of bottomland forests, center pivot irrigation, and use of fertilizer and pesticides. These activities, taken together, are not expected to significantly affect populations or the habitats of least terns, piping plovers, or the pallid sturgeon, although there is some potential for increased field runoff to enter the river. Given the large releases from the Gavins Point Dam, however, the potential for any water quality degradation is slight.

It is possible that a water supply project for southeast South Dakota communities could be developed in the area, utilizing Missouri River water as a source. This action, however, would involve an intake structure in the river, and would be subject to federal review and permit requirements. There is also local interest in a new highway and bridge crossing of the MNRR in the vicinity of Mulberry Point, providing linkage of Dixon County, NE residents, with services in Vermillion, South Dakota. This action would also be subject to federal review and permit requirements.

## 6.0 CONCLUSIONS

### 6.1 Terns and Plovers

It is determined that direct and indirect effects of mainstem operations have a significant, adverse effect on interior least terns and piping plovers. The direct effects consist of flooding of the colonies, to the extent of curtailing nesting success, and eroding of some of the sandbar habitat. Mainstem operations also have indirect effects in that the area of the scour zone is reduced, allowing vegetation encroachment, and loss of sandbar habitat. This, in turn, concentrates birds in areas where they are susceptible to growing numbers of predators and recreationists.

Indirect impacts related to the recreation activities along the MNRR have potential to significantly impact nesting success of the birds. Added visitation would increase competition between birds and recreationists for available sandbar space during the mid-June to August flow period. Future federally subsidized bank stabilization is expected to be minor due to lack of economic justification, related to the rural nature of the predominating land uses. Future private bank stabilization is subject to federal permit requirements and future demand for this work is expected to be limited to areas near existing and proposed new residential areas, and eroding bankline proximal to center pivot irrigation systems. The bank stabilization is not expected to affect the birds, but indirect, adverse impacts related to additional recreation at or near nesting colonies would be expected. Other potential permitted actions, including bridges, river access areas, and water diversions are not expected to have a direct effect. However, associated increased residential development could further degrade existing sandbar habitat.

## 6.2 Pallid Sturgeon

Aquatic habitat for the pallid sturgeon would not be affected by further bank stabilization or by additional recreation. If existing fishing harvest regulations at a later date are determined to be lenient, sport fishing of these species can be eliminated. It is concluded that the MNRR action is not likely to jeopardize the continued existence of the pallid sturgeon. Related actions; e.g., the operation of the mainstem dams, however, was not addressed. It is the subject of a separate endangered species consultation with the U.S. Fish and Wildlife Service.

## 6.3 Cumulative Effects

These actions; e.g., private bank stabilization, residential development and additional cultivation of the river corridor is expected. Private bank stabilization will not directly affect listed species, but would likely lead to more intense development of the corridor and more recreation impacts on the terns and plovers. The pallid sturgeon would not be adversely affected by additional residential development and bank stabilization due to its existing transient habitat use of the area. Additional cultivation of lands along the river, would

not be expected to degrade the habitat or affect the populations of the listed species.

#### 6.4 Management Measures

Along the MNRR, additional experimental work is needed to identify measures to reduce impacts of the mainstem system and the MNRR on terns and plovers. These are the (1) continuation of sandbar clearing; (2) evaluation of visitor education and management; (3) monitoring of shorebird breeding success; (4) effects of flow level manipulation, especially winter flows, on arresting vegetation encroachment or scouring islands; and (5) additional hydraulic studies on the sandbar erosion and channel stability problem.

The experimental clearing and chemical control program of vegetation on MNRR sandbars should be continued in order to identify any possible, more efficient measures and an integrated approach. Examples of other measures would include fire, biological control, and dredging. The experimental visitor education and management program should continue, including special monitoring during peak visitation periods. Visitor counts should be taken periodically in order to evaluate growth trends.

Assessing breeding success of the birds is required annually, with special consideration given to determination of fledging ratios and mortality rates. This will require further banding work. Experimental use of predator enclosures and other control measures should be evaluated on the islands receiving vegetation management.

Use of controlled ice jams, or release of additional flows during river ice conditions, should be evaluated because of its potential to create higher stages, flood and scour vegetation, transport more sediment within the channel, and form higher islands. A moderate flow release over an ice pack during a moderately cold winter would break up the ice sheet, create some small jams, and lead to local scour and erosion on the islands.

Loss of sandbar islands due to erosion exceeds their rate of formation. Hydraulic studies, examining erosion/accretion rates and future channel stability is recommended.

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